Appendix F

Dock Assessment by Symonds Consulting Engineers

MAURY ISLAND GRAVEL MINE

STRUCTURAL CONDITION ASSESSMENT OF EXISTING DOCK

Prepared for:

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Bellevue, Washington

June 12, 2000

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INDEX

Maury Island Gravel Mine
Structural Condition Assessment of Existing Dock
June 12, 2000

EXECUTIVE SUMMARY

Symonds Consulting Engineers has performed a structural condition assessment of the existing dock at the proposed Lone Star gravel operation on Maury Island, Washington. The findings from this assessment will be used by Jones & Stokes to supplement their impact analysis on the marine environment resulting from repair and maintenance of the dock structure.

The structural condition assessment was conducted in accordance with standards established by the American Society of Civil Engineers, "Guideline for Structural Condition Assessment of Existing Buildings," and Washington State Ferries Memorandum, "Timber Pile Inspection Guidelines."

The structural condition assessment of the dock focused on answering three study questions posed by King County. Summary responses to those questions are as follows:

1. An estimated one hundred sixteen piles (40% of the total piles) need to be replaced to make the dock capable of operating as proposed by the applicant.
2. Following the initial dock repairs, *Symonds* anticipates one third of the remaining piles would need to be replaced at five, ten and fifteen years in the future.
3. In *Symonds* opinion, replacing the existing dock with a new, low-maintenance dock would result in less in-water work.

INTRODUCTION

The dock at the Maury Island gravel mine has not been used for about twenty years. Lone Star Northwest (now doing business as Glacier Northwest) has submitted an application to conduct gravel mining activities on Maury Island. As a part of their mining activities, Lone Star Northwest proposes to use the existing dock to support a conveyor system that would transfer sand and gravel to barges.

An estimate of repairs necessary to make the dock functional was submitted by the applicant and was described in the Draft Environmental Impact Statement (DEIS). This estimate of repairs included replacing approximately thirty of the existing timber pilings and repairing some additional piles by "fresh-heading" (a maintenance activity involving pulling up the pile and cutting away the damaged portion). In addition, the estimate of repairs included replacing or securing about twenty-five percent of the dock's decking, stringers and supporting timbers.

Many people submitted formal comments on the DEIS that questioned the accuracy of the estimate of repairs necessary to make the dock functional. In response to these comments, King County authorized additional analysis to assess the structural soundness of the dock and needed repairs to the dock.

Symonds Consulting Engineers performed the structural condition assessment of the dock authorized by King County. The findings from this assessment will be used by Jones & Stokes to supplement their impact analysis on the marine environment resulting from repair and maintenance of the dock structure.

The purpose for performing the structural condition assessment was to gather sufficient information about the structural soundness and need for repairs to the dock so that the following three study questions could be answered:

> *Study Question 1. Approximately how many pilings would need to be replaced on the dock, fenders, and dolphins to make the dock capable of operating as proposed by the applicant?*
>
> *Study Question 2. Assuming relatively constant use, approximately how often would repairs need to be conducted and what would be the extent of those repairs?*
>
> *Study Question 3. Over the long run, would replacement of the existing dock with a new, low-maintenance dock result in less in-water work?*

The structural condition assessment was conducted in accordance with standards established by the American Society of Civil Engineers, "Guideline for Structural Condition Assessment of Existing Buildings." The condition of the dock superstructure and pilings accessible by boat or afoot from walkways or ground surface was visually observed. No destructive testing was performed. Diving to observe the condition of pilings below the limiting depth of water was not within the scope of this assessment.

The Washington State Ferries (WSF) Memorandum dated September 20, 1999, "Timber Pile Inspection Guidelines," was used as a guide to inspect the condition of the pilings. Under the WSF Guidelines, pilings are rapped with a two-pound hammer to detect whether the pile has been hollowed out by marine organisms. If a pile is struck within a few feet of a cavity, the pile will sound hollow. The size, depth and location of any holes in a pile are noted, and a twelve-inch screwdriver is used to probe the hole and estimate its depth. The extent of marine growth on the pilings is noted. Creosote loss, an important indicator of the remaining life of pilings, is to be noted. An estimate of the remaining cross-section of pile is made based on the following criteria:

Condition	Description
100%	No apparent damage or marine borer attack
80-100%	Incipient marine borer attack, holes <1" deep, minor surface abrasions
50-80%	Moderate damage or apparent marine borer attack, holes >1" deep
30-50%	Advanced damage or extensive marine borer attack, 2" shell or fist-sized cavities
<30%	Pile destroyed or no longer of load-bearing capacity, large cavities, and cat faces on pile
0%	Pile not in contact with cap or ground

No drawings of the existing structure were available for review. It is *Symonds* understanding that some repairs were made to the dock approximately ten years ago. These repairs reportedly included replacement and repair of about twenty-five pilings in the dolphins and fender piles. However, no records of these or any other repairs or maintenance were available for review.

DOCK DESCRIPTION

The timber dock serving the gravel quarry is located on the east side of Maury Island approximately half way between the Gold Beach Community and the Sandy Shores Community. See Figures 1 and 2. The dock facility consists of three component sections referred to in this report as the timber trestle, barge mooring dock and mooring dolphins. See Photograph 1.

Timber Trestle

The trestle extends east from the shoreline and is approximately two hundred sixty-five feet long. The trestle runs at an incline of approximately 10:1 from the shoreline to an outer loading tower at the end of the trestle. See Photograph 1. The height at the tower was estimated at approximately fifty feet above Mean Lower Low Water (MLLW).

The structure of the trestle consists of thirteen 2-pile bents spaced approximately 20'-6" on center. See Figure 3. The piles at each bent are spaced twelve feet apart. Two levels of framing are supported by the pile bents. Framing along the top of the timber trestle supports the gravel conveyor system. At a lower level, below the gravel conveyor, a catwalk provides access from the shoreline out to the loading tower and barge mooring dock. There is bolted cross-bracing between the catwalk level and the top of the trestle. This cross-bracing consists of 4" x 12" timbers and is located at bents numbered 4 through 13. Similar cross-bracing is located longitudinally between bents 4 and 5, 6 and 7, 8 and 9, 10 and 11, and 12 and 13. See Photograph 2.

Typically the piles extend through the catwalk framing and support the framing along the top of the trestle. However, at bents 12 and 13, the piles extend to the catwalk level only and 12" x 12" timber columns extend above the piling to support the top of the trestle. Pile caps are 12" x 12" timber connected with drift pins at bents 1 through 11. Bents 12 and 13 have similar timber caps spanning between the tops of the timber columns. The gravel conveyor truss made up of welded steel angles spans between and is supported by the pile caps. There is no provision for containment of aggregate spillage on the existing truss. Walkways are located on the north and south sides of the conveyor truss. The walkways are constructed of stringers spanning longitudinally between pile caps. The stringers support 4" decking spanning transversely.

The lower catwalk is constructed of two 4" x 12" cross beams spanning between and bolted through each pile. Beams spanning longitudinally frame over the two 4" x 12" cross beams and support stringers spaced at approximately ten feet on center. Three 4" x 12" decking timbers running longitudinally over the stringers make up the walking surface. See Photograph 3.

Barge Mooring Dock

The barge mooring dock runs in a north/south direction, approximately parallel to the shoreline. See Photographs 4, 5 and 6. The structure of the mooring dock is made up of sixteen pile bents. Each pile bent is comprised of an outer fender pile, two bearing piles, and one batter pile which is driven at approximately a 4:1 angle to brace the bent. To help transfer barge mooring loads to piles, timber caps span both transversely and longitudinally interconnecting the piles. Stringers span longitudinally between the bents, and decking spans across the stringers.

Mooring Dolphins

There are currently ten mooring dolphins, five located north and five located south of the barge mooring dock. Each dolphin is constructed from approximately nineteen piles which are secured with upper and lower wrappings of wire rope. The center pile extends approximately three feet above the outer piles to receive a mooring rope.

DISCUSSION OF SITE OBSERVATIONS

Symonds' staff visited the site twice. The first site visit was conducted on January 21, 2000 and a second site visit occurred on February 17, 2000.

General information about the structure was gathered during the site visit on January 21. Since no drawings of the existing structure were available for review, our description of the dock is based on our site observations of the structure. Also, the general layout of the pile locations was recorded for use during our site visit on February 17. Bent numbers were assigned so that specific information relating to a given pile could be recorded and the pile location later identified. See Figure 3 and Table 1.

On January 21, 2000, *Symonds*' staff observed the condition of the superstructure including the upper level framing and the lower catwalk framing of the timber trestle, and the framing at the barge mooring dock. In addition, the condition of pilings at bents 1, 2 and 3 were observed. On February 17, 2000, the condition of the remaining piles was observed. A description of *Symonds*' observations during both site visits follows.

January 21, 2000 Site Visit

Condition of the of Existing Dock Superstructure

The gravel conveyor truss and walkway framing along the top of the timber trestle were accessible from the embankment out to about bent 5 only. Opinions of the upper level framing beyond bent 5 are based on visual observations from the catwalk below. The gravel conveyor truss is a welded steel angle truss supported by the timber structure. In the past, the truss was used to support the conveyor belts. The conveyor belt, bearings, and motors have been removed. A structural analysis of the truss is beyond the scope of this report. However, extensive superficial rust was noted on the steel truss, and rusting of welds on the truss is a concern. *Symonds* recommends further analysis of the condition of the truss prior to putting the conveyor back into operation. See Photograph 7.

Timber used in the upper trestle construction above the pilings is untreated fir.

The condition of the 12" x 12" timber pile caps at bents 1 through 5 was visually observed, and the caps were probed with a 12-inch screwdriver. The pile caps at bents 1, 2, 3 and 5 are extensively deteriorated and require replacement. The pile cap at bent 4 appeared to be in good condition. The condition of the remaining pile caps could not be observed because the caps were not accessible. However, it is likely the remaining pile caps are also deteriorated and require replacement since they are constructed of untreated timber.

Walkways run along both sides of the gravel conveyor truss. Approximately one third of the southern walkway is missing and is assumed to have fallen off. See Photograph 2. There is no obvious deterioration of the north walkway. Since the upper level of the trestle could be only partially accessed, *Symonds* assumes the condition of the framing along the top of the trestle which was not accessible including the walkways is similar to the condition of the members in areas which were accessible. Handrails were missing along the walkways.

At the lower catwalk, the decking, stringers, longitudinal beams and cross beams show signs of incipient rot to extensive deterioration. Pocket rot in the tops of the 4" x 12" stringers may preclude fastening of new decking by nailing. Hand railing for the lower catwalk is either missing or deteriorated to the point of being unsafe.

Surface rot was noted on the 12" x 12" trestle columns at bent 12. The bottom sections of the trestle columns at bents 12 and 13 have been repaired by inserting a repair post and splice. See Photograph 11. In *Symonds*' opinion, the repair post and splice may accelerate further deterioration of the structure due to their end grain exposure. If the dock is repaired rather than replaced, *Symonds* recommends this connection be analyzed to determine the adequacy of the repair prior to commencing gravel mining operations. Structural analysis of the adequacy of the bolted splice connection is beyond the scope of this report.

The longitudinal and transverse bracing generally appears to be adequate at this time. However, the bracing members show signs of incipient rot. In *Symonds'* opinion, replacement of the bracing will be required within the next ten years.

The south portion of the outer loading tower has collapsed. See Figure 3 and Photograph 8. Beams, which appeared to be 4" x 12" timbers, are hanging haphazardly. *Symonds*' staff considered this portion of the dock unsafe and did not attempt to access this area. Framing within the tower area at the catwalk level shows signs of fire damage and extensive rot. See Photographs 9 and 10. Decking exists only below the outer portion of the tower section at bents 20 through 24.

Most of the decking along the barge mooring dock, both north and south of the outer loading tower, is either missing or severely deteriorated. The area was inaccessible. No tie-off cleats were observed along the mooring dock.

The outboard timber caps on the barge mooring dock are extremely deteriorated. The longitudinal caps, used to help spread the load from barges over several bents, and the transverse caps, used to spread the load between the outboard caps, ("A" and "B" lines as shown in Figure 3) are extremely deteriorated and should be replaced in their entirety.

Condition of Piles

At the time of the January 21, 2000 site visit, the lowest tide was approximately +6.9 MLLW. The height of the tide precluded visual observation of the pilings in the tidal zone where marine borer damage would be expected. Observations of the piles within the tidal zone were conducted during the February 17, 2000 site visit.

Records of the pile installation including pile classification, method of creosote treatment, date of installation, driven depth of piling, bearing capacity and pile blow count for pile bearing were not available for review. Timber piles are classified in accordance with Commercial Standard CS 249. Based on our field observations, *Symonds* determined the timber pilings are creosote treated Class B piling, with pile butts estimated at approximately 12-inches in diameter.

The condition of the piles at Bents 1, 2 and 3 was observed from the cap to mud line. These pilings are generally above the water line except for extremely high tides and stormy weather. The majority of the pilings were rated 80-100%. Some significant observations are as follows:

- Pile 1-N visually appears to be in good condition. However, the pile sounded hollow when rapped with a 2-pound hammer indicating a cavity exists within the pile. This piling is suspect and may require replacement. The pile should be examined more closely when Cap 1 is replaced.
- Piles at Bents 2 and 3 have superficial abrasions on the surface due to debris. Load-bearing cross sections of these piles were rated at 80%-100%. However, assuming continued abrasion of the piles, *Symonds* estimates replacement of these piles will be required within ten years.

The condition of the piles at Bents 4 through 11 was visually observed from waterline to the lower catwalk. In the vicinity of the lower catwalk, piles were rapped with a two-pound hammer. A two-inch deep check running the upper length of pile 8-N was noted and is a potential avenue for marine borers.

February 17, 2000 Site Visit

Condition of Piles (Continued)

Typically, pile inspections are accomplished at the lowest possible tide in order to expose the maximum length of piling to view. Generally, pile inspections are conducted during the time period two hours prior to and two hours after the local low tide.

Low tide for February 17, 2000 occurred at 9:19pm. The pile inspection commenced at approximately 7:00pm and was completed at approximately 9:30pm. Based on NOAA, National Ocean Service Station No. 9447130, tide predictions for Seattle, Washington varied from approximately +1.0 to −1.8 MLLW during the inspection. Tidal correction factors from Seattle to Maury Island are negligible.

A three-person team from Symonds Consulting Engineers conducted the pile inspection. A 14-foot aluminum workboat with a 10-hp outboard motor was used to access the pilings. One member of the team remained ashore while the other two members of the team, the boat operator and pile inspector, observed the condition of the piles. Pile observations were radioed to shore for recording. Since the low tide occurred during the hours of darkness, the piles were inspected using an 800,000-candle power sealed beam light to illuminate the piling above and below the waterline. Headlamps in conjunction with hardhats were also used. The moon phase was waxing to near full which also provided some illumination. Weather conditions were clear with no wind; the air temperature was approximately 32°F.

Piles were visually observed and rapped using a 2-lb hammer to listen for hollow sounds. A 12-inch screwdriver was also used to probe the depth of holes. This method is consistent with life-cycle cost modeling inspection done by Washington State Ferries on their marine timber facilities.

Pile conditions reported indicate the estimated remaining cross-sectional area based on the following general criteria:

Condition	Description
100%	No apparent damage or marine borer attack
80-100%	Incipient marine borer attack, holes <1" deep, minor surface abrasions
50-80%	Moderate damage or apparent marine borer attack, holes >1" deep
30-50%	Advanced damage or extensive marine borer attack, 2" shell or fist-sized cavities
<30%	Pile destroyed or no longer of load-bearing capacity, large cavities, and cat faces on pile
0%	Pile not in contact with cap or ground

The trestle portion of the dock is designated as bents 1 through 13. The condition of the pilings at bents 1, 2 and 3 was observed during the January 21, 2000 site visit.

During the February 17, 2000 site visit, pilings at bents 5 through 9 were exposed from the pile cap to mud line. The majority of the pilings were rated 80-100% with superficial abrasions and moderate creosote loss. All of the piles except those at bents 1, 2 and 3 which are generally above the water line were noted as being covered with moderate to heavy marine growth. Some significant observations are as follows:

- Pile 5-S has significant abrasions on the surface. The load bearing cross section of this pile was rated at 80%-100%. However, assuming continued abrasion of the pile, *Symonds* estimates replacement of the pile would be expected within ten years.
- Pile 6-N appears to have incipient rot around a knothole. *Symonds* anticipates continued exposure to marine elements will cause rapid decay of the pile.
- Pile 8-N has a one-inch diameter hole estimated between eight and ten inches deep located at approximately 8'-0" above the mud line. This pile is rated <30% and must be replaced.
- Pile 9-S has a large cavity at the mud line. This pile is rated <30% and requires replacement.

Piling in Bents 10 through 13 were inspected above the waterline and visually inspected to approximately 5-feet blow the waterline. The mud line could not be seen beyond bent 12. The majority of the pilings were rated 80-100% with minor creosote loss and moderate marine growth. Some significant observations are as follows:

- Pile 12-N has significant creosote loss and shows signs of incipient Limnoria attack. Although the pile is rated 80-100%, *Symonds* anticipates rapid deterioration of the pile and frequent monitoring to be necessary for continued verification of the pile rating.
- Pile 13-N has a two-inch deep hole and a scar which appears to have been caused by a chainsaw. The pile is rated 50-80%.

The barge mooring dock is designated as bents 14 through 29. See Figure 3. Each pile bent is comprised of an outer fender pile, two bearing piles, and one batter pile which is driven at approximately a 4:1 angle to brace the bent. Because much of the timber decking is either deteriorated or missing, the barge mooring dock was not accessible during our January site visit. This area is accessible only by boat.

Heavy creosote loss and incipient Limnoria attack can be found on many piles in the barge mooring dock area. With continued exposure to marine elements, *Symonds* expects rapid decay of these pilings over the next ten years.

Some of the bearing piles have pulled loose from their pile caps. In other instances, pile caps are missing.

Transverse batter pilings are present at bents 14 through 29, and longitudinal batter piles are present at bents 18, 20, 23, and 26. The batter piles are connected to the outboard piles along gridline "A" with bolts and steel wire rope. The bearing piles are dapped to receive the batter piles. The wire rope is corroded and should be replaced. Bolted connections should receive closer inspection, and dapped surfaces should be inspected for rot.

There is one fender pile at each of bents 14 through 29 and three additional fender piles along the north side of bent 29. Fender pilings are attached to the transverse caps with U-bolts. Many of the U-bolts are broken or have torn loose from the deteriorated pile caps. Typically, the fender pilings show signs of wear and, in *Symonds'* opinion, may not be capable of withstanding lateral loads from barge docking. Depending upon barge traffic and docking techniques, replacement of fender piling may be required on an ongoing basis.

There are 10 mooring dolphins at the site. Five dolphins are located south of bent 14, and five dolphins are located north of bent 29. The dolphins consist of approximately 19 piles each, with the center pile extending approximately 3 feet above the exterior piles for the purpose of receiving a mooring rope. Dolphin clusters are secured with upper and lower wraps of wire rope.

The northern most dolphin N-1 has been destroyed. Replacement of the entire dolphin will be required. A dolphin stub designated N-2.5 was observed below the water line and appeared to have been completely broken off. Dolphin N-3 is leaning shoreward and appears to have been hit, possibly damaging pilings below the waterline. Dolphin S-3 also appears to have been hit and has a 10° lean to the north and may have damage below the waterline. Outboard pilings at most dolphins appear to have been worn to the point of being destroyed and require replacement.

Lower wire rope wraps were missing on most dolphins or were badly deteriorated. Upper wire rope wraps show signs of extensive deterioration. The wire rope wraps on all the dolphins should be replaced and all damaged or deteriorated dolphin pilings replaced.

See Figure 3 and Table 1 for a summary of the condition of all the dock pilings.

RESPONSE TO STUDY QUESTIONS

Study Question 1. Approximately how many pilings would need to be replaced on the dock, fenders, and dolphins to make the dock capable of operating as proposed by the applicant?

Based on *Symonds'* experience, it is likely that upon removal of the deteriorated timber framing and pile caps, piles rated as having adequate cross-section will be identified as being deteriorated and require replacement. Also, deteriorated piles often go undetected when they are covered with moderate to heavy marine growth as noted on the majority of the pilings. The numbers below include an allowance for replacement of piles identified during construction as needing replacement. Based upon our site observations and experience with existing timber pile structures, *Symonds* estimates the minimum number of pilings that need to be replaced to make the dock capable of operating as proposed by the applicant is as follows:

Minimum Pile Replacement			
	Total Number Existing Piles	*Minimum Number Piles Replaced*	*% Piles Replaced*
Dock:			
Timber Trestle			
-bearing piles	*26*	*4*	*15*
Barge Mooring			
-bearing piles	*32*	*7*	*22*
-batter piles	*20*	*5*	*25*
Fenders	*24*	*10*	*42*
Dolphins	*190*	*90*	*47*
TOTAL	*292*	*116*	*40*

Any pile identified during the initial repair work as being deteriorated should be replaced. If "suspect" piles are left in place, there is an increased risk of unanticipated failures occurring between regularly scheduled maintenance intervals.

Study Question 2. Assuming relatively constant use, approximately how often would repairs need to be conducted and what would be the extent of those repairs?

Although the frequency of repairs for a given facility is difficult to predict, generally, the more comprehensive the repair, the longer it will be until the next repair. It is more cost efficient to do comprehensive capital repairs to a marine facility than the minimum repair required for operation. A major cost component in any marine facility repair is the "mobilization costs" for the equipment. A pile driving derrick, pile/debris barge, and tug service are required for each repair and may cost in the range of $10,000 to $20,000 for each mobilization. The percentage cost for mobilization compared to the overall project cost is less for larger projects than for smaller projects. Therefore, it is more economical to make as many repairs as possible when a derrick is on site and lengthen the period between repair intervals.

The pile caps are "simply supported." In other words, they span between two piles. If the pile at either end of a pile cap were to fail, there would be no support for the superstructure at the failed pile location. The pile would have to be replaced to restore support for the dock. If only a minimum repair effort is made, then it is likely that repairs will need to be made on an ongoing basis as individual piles fail.

One repair option to make the dock capable of operating as proposed is to replace the entire superstructure and replace the minimum number of piles. If this option were selected, the piles could be concrete, steel or chemonite treated timber piles. However, chemonite treated timber piles are feasible only if acceptable to permitting agencies. Materials for the new superstructure could be of whichever framing material, timber, steel or concrete, is desired and connections to piles detailed appropriately.

A second repair option is to replace only the areas of the superstructure which are unsafe and attempt to save some portions. The minimum number of piles necessary to make the dock capable of operating would be replaced. In *Symonds*' opinion, it would be difficult and perhaps economically prohibitive to connect the existing timber framing members to new steel or concrete piles. It would be easier to install and make connections to the existing framing if Chemonite treated replacement piles were used than if either steel or concrete piles were used. However, either steel or concrete piles could be used where mooring dolphin replacement is required. *Symonds* does not recommend this or any repair option which does not replace the entire superstructure framing.

Assuming a fairly comprehensive repair now (year 2000) with repairs spaced approximately 5-years apart, the following table may be used for general guidance in estimating pile replacements:

PILE REPLACEMENT SCHEDULE

		YEAR			
	Total Number Existing Piles	*2000*	*2005*	*2010*	*2015*
Dock:					
Timber Trestle					
-bearing piles	*26*	*4*	*8*	*7*	*7*
Barge Mooring					
-bearing piles	*32*	*7*	*9*	*8*	*8*
-batter piles	*20*	*5*	*5*	*5*	*5*
Fenders	*24*	*10*	*5*	*5*	*4*
Dolphins	*190*	*90*	*40*	*30*	*30*
TOTAL	*292*	*116*	*67*	*55*	*54*

The above pile replacement schedule assumes a replacement rate of approximately 40% the first year, and approximately 20% replacement during the fifth, tenth, and fifteenth years. Because most of the piles are showing creosote loss, an accelerated rate of pile deterioration can be expected in the future. In *Symonds'* opinion, all of the piles will require replacement within fifteen years. If the pilings were inspected on an annual basis, a more accurate schedule for repairs could be developed allowing for adequate planning, budgeting and scheduling of down periods for capital repairs.

Study Question 3. Over the long run, would replacement of the existing dock with a new, low-maintenance dock result in less in-water work?

In *Symonds'* opinion, a new, low-maintenance dock would result in less in-water work. This opinion is based on the following observations:

- It is likely that additional piling, particularly the fender and dolphin piles will fail with renewed loading. It is likely that the maximum life of any remaining timber piling will not exceed 15 years.
- The dock structure is not currently designed to contain aggregate spillage and it is unlikely that it can easily be retrofitted with a spillage containment system. A spillage collection system could more easily be incorporated into a new structure and eliminate in water retrieval of spilt aggregates.
- The existing steel truss for the conveyor system is constructed from welded angle steel. The truss shows signs of superficial rusting; however it is more likely that the rusted weld connections will fail with renewed vibration from operation requiring ongoing maintenance.
- A new dock could be constructed from steel or concrete piling, which would not leach potentially toxic materials into the water. Pile spacing could be maximized and steel grating used to help reduce shading impacts on adjacent eelgrass beds. In-water impacts would be limited to a onetime operation and not recurring at 5-year intervals.
- Treated replacement timbers of the size and length of existing timbers may be difficult or impossible to obtain. Spot replacement of timbers will be very difficult and costly to accomplish while trying not to damage adjacent timbers during the repair.
- Unanticipated structural failures could cause costly delays in delivery of aggregate materials. Ongoing maintenance can also be disruptive to production operations.
- Replacement of creosote treated fender piling with steel H-piles, surfaced with high density polyethylene (HDPE) facing, would provide an inert rubbing face that would help absorb the energy from barge docking and not leach toxic materials into the water.

CONCLUSIONS AND RECOMMENDATIONS

In *Symonds* opinion, the dock is in poor condition and is unsafe for use in its current condition. Substantial repairs will be required to meet the current Washington Industrial Safety and Health Act (WISHA) requirements and minimum structural loading for operation.

Much of the superstructure is constructed of untreated timber and shows signs of incipient to extensive rot. Most areas of decking and handrails are either missing or extensively deteriorated. Stringers and pile caps are also deteriorated. As a minimum, *Symonds* recommends replacement of the superstructure including all decking, stringers and pile caps. Other items such as the installation of guardrails, access ladders, life rings, fall arrests and fire extinguishers will be required in accordance with WISHA standards. Approximately 34,000 board feet of timber will be required to replace the superstructure.

Further, approximately forty percent of the pilings require replacement now to make the dock operational, and no pile is expected to have a remaining life greater than fifteen years. Therefore, *Symonds*' recommends replacing all of the pilings as well as the superstructure with a new, low-maintenance dock.

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27292
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APPENDIX A

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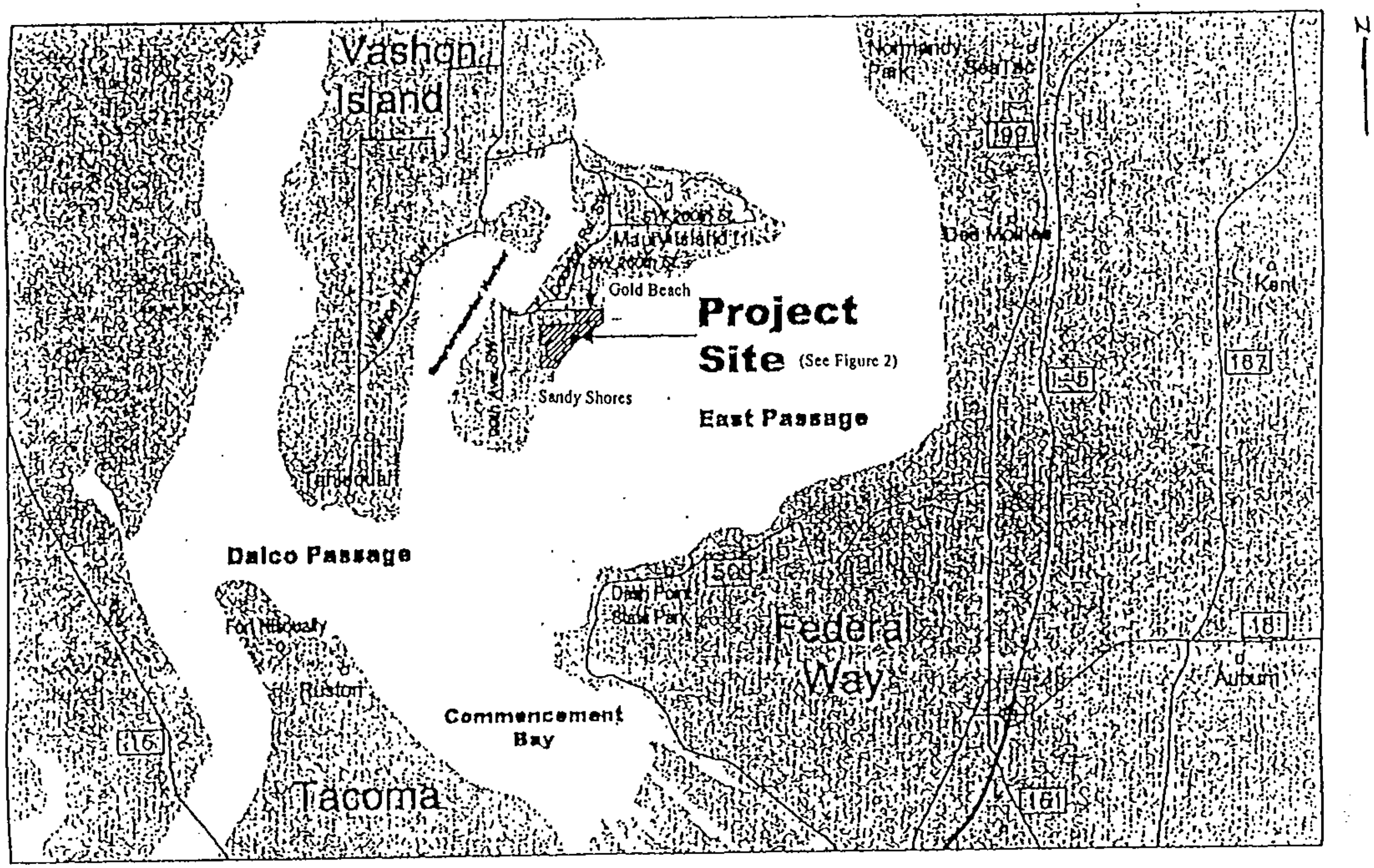

FIGURE 1 Project Vicinity Map

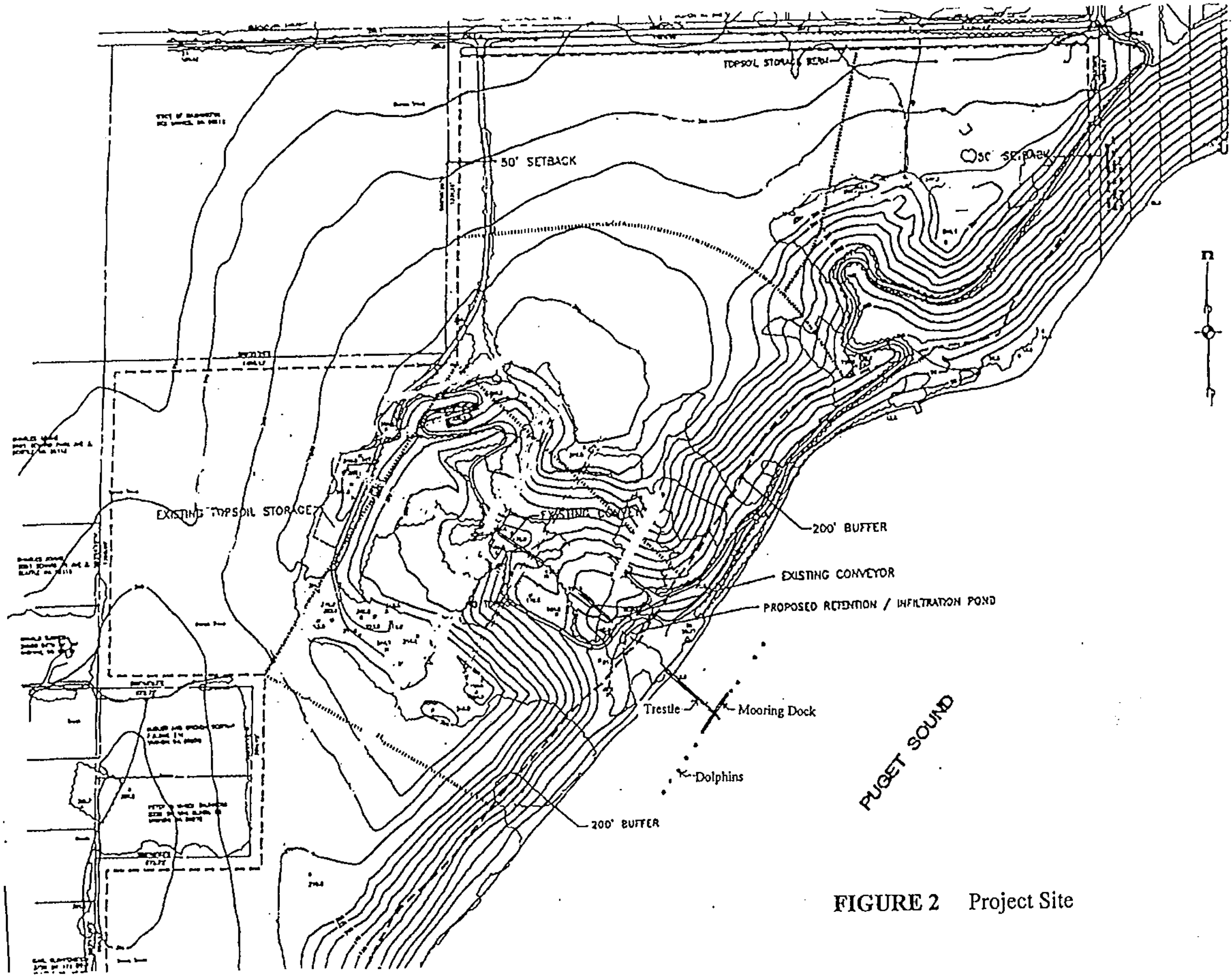

FIGURE 2 Project Site

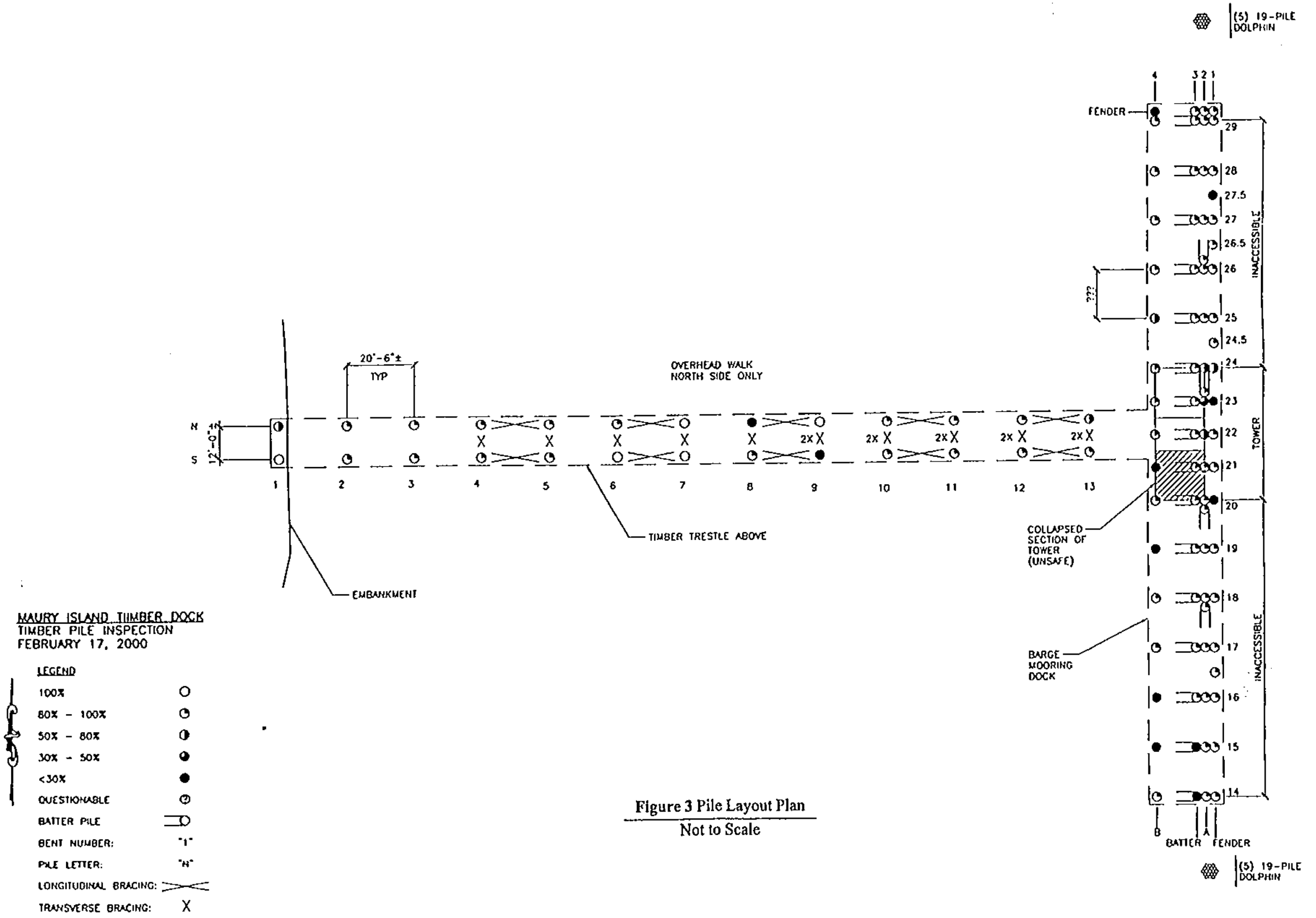

Figure 3 Pile Layout Plan
Not to Scale

TABLE 1
Pile Observation Report
Maury Island Gravel Mine
Strucutral Condition Assesment of Existing Dock

Inspector: Bill Lider
Inspection Date: 02/17/00
Weather Conditions: Clear, Calm, 32°
Tide Level: -1.8

Bent #	Pile #	Marine Growth	Pile Material	Size	Holes/Cavities	Pile Bracing	% Remain Pile Condition	Remarks
1	N	None	Timber	Class B			50-80	No visual sign of rot on pile, sounding indicates possible rotten core.
1	S	None	Timber	Class B		top cap rotten on S end	80-100	No visual sign of rot on pile.
2	N	None	Timber	Class B			80-100	Superficial abrasions, repair post/splice 12"x12"x19" w/ sister connection
2	S	None	Timber	Class B			80-100	Superficial abrasions, repair post/splice 12"x12"x3' w/ sister connection
3	N	None	Timber	Class B			80-100	Superficial abrasions
3	S	None	Timber	Class B			80-100	Superficial abrasions
4	N	Minimal	Timber	Class B			80-100	Superficial abrasions
4	S	Minimal	Timber	Class B			80-100	Superficial abrasions
5	N	Moderate	Timber	Class B			80-100	Minor abrasions
5	S	Moderate	Timber	Class B			80-100	Significant abrasions
6	N	Moderate	Timber	Class B			80-100	Incipient rot around knot hole
6	S	Moderate	Timber	Class B			100	Minor creosote loss
7	N	Moderate	Timber	Class B			100	
7	S	Moderate	Timber	Class B			100	Minor creosote loss
8	N	Moderate	Timber	Class B	8-10" deep, 1" dia hole, 8' above mud line		<30	2" deep check running upper length of pile
8	S	Moderate	Timber	Class B			80-100	Minor creosote loss
9	N	Moderate	Timber	Class B			100	Minor creosote loss
9	S	Moderate	Timber	Class B	Large cavity @ mud line		<30	
10	N	Mod-Heavy	Timber	Class B			80-100	Minor creosote loss
10	S	Mod-Heavy	Timber	Class B			80-100	Minor creosote loss
11	N	Mod-Heavy	Timber	Class B			80-100	Minor creosote loss
11	S	Mod-Heavy	Timber	Class B			80-100	Minor creosote loss
12	N	Mod-Heavy	Timber	Class B			80-100	Short pile, significant creosote loss, incipient Limnoria attack
12	S	Mod-Heavy	Timber	Class B			80-100	Short pile
13	N	Mod-Heavy	Timber	Class B	2" deep hole, possible chainsaw scar		50-80	Short pile, can't see bottom
13	S	Mod-Heavy	Timber	Class B		brace 1' above water line is rot	80-100	Short pile, can't see bottom
14	Fender	Heavy	Timber	Class B			80-100	
14	A	Heavy	Timber	Class B		12x12 cap rot w/ bush growth	80-100	
14	Batter	Heavy	Timber	Class B	major cavity		<30	Incipient Limnoria attack
14	B	Heavy	Timber	Class B		No cap	80-100	Incipient Limnoria attack
15	Fender	Heavy	Timber	Class B		no cap, no brace	80-100	
15	A	Heavy	Timber	Class B			80-100	
15	Batter	Heavy	Timber	Class B	6" deep, 3" dia cavity		<30	
15	B	Heavy	Timber	Class B	1" deep knot hole, major cavity		<30	
16	Fender	Heavy	Timber	Class B			80-100	Heavy creosote loss, Incipient Limnoria attack
16	A	Heavy	Timber	Class B			80-100	Heavy creosote loss, Incipient Limnoria attack
16	Batter	Heavy	Timber	Class B			80-100	Heavy creosote loss, Incipient Limnoria attack
16	B	Heavy	Timber	Class B	12" deep hole		<30	Heavy creosote loss, Incipient Limnoria attack
16.5	A	Heavy	Timber	Class B		12x12 cap rotten	80-100	Incipient Limnoria attack, moderate creosote loss
17	Fender	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
17	A	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
17	Batter	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
17	B	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
18	Fender	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
18	A	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss

TABLE 1
Pile Observation Report
Maury Island Gravel Mine
Structural Condition Assesment of Existing Dock

Bent #	Pile #	Marine Growth	Pile Material	Size	Holes/Cavities	Pile Bracing	% Remain Pile Condition	Remarks
18	Batter	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
18	Long-Batter	Heavy	Timber	Class B			80-100	Rotten jack stringer, Incipient Limnoria attack, moderate creosote loss
18	B	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
19	Fender	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
19	A	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
19	Batter	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
19	B	Heavy	Timber	Class B	Major cavity		<30	
20	Fender	Heavy	Timber	Class B	Destroyed		<30	Incipient Limnoria attack, moderate creosote loss
20	A	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
20	Batter	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
20	Long-Batter	Heavy	Timber	Class B			80-100	Broken loose from cap, cable rusted, Incipient Limnoria attack, moderate creosote loss
20	B	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
21	Fender	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
21	A	Heavy	Timber	Class B		x-brace to B destroyed	80-100	Incipient Limnoria attack, moderate creosote loss
21	Batter	Heavy	Timber	Class B			80-100	
21	B	Heavy	Timber	Class B	Destroyed		<30	
22	Fender	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
22	A	Heavy	Timber	Class B	Major Cavity		30-50	
22	Batter	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
22	B	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
23	Fender	Heavy	Timber	Class B	Destroyed		<30	Incipient Limnoria attack, moderate creosote loss
23	A	Heavy	Timber	Class B	Major Cavity		30-50	Blocking shifted, cable rusted
23	Batter	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
23	Long-Batter	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
23	B	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
24	Fender	Heavy	Timber	Class B	1" deep hole		50-80	
24	A	Heavy	Timber	Class B	1" deep hole		50-80	
24	Batter	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
24	B	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
24 5	Fender	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
25	Fender	Moderate	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
25	A	Moderate	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
25	Batter	Moderate	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
25	Long-Batter	Moderate	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
25	B	Moderate	Timber	Class B	1" split off		50-80	
26	Fender	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
26	A	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
26	Batter	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
26	B	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
26 5	Fender	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
27	Fender	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
27	A	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
27	Batter	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
27	B	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
27 5	Fender	Heavy	Timber	Class B			<30	Destroyed

TABLE 1
Pile Observation Report
Maury Island Gravel Mine
Strucutral Condition Assesment of Existing Dock

Bent #	Pile #	Marine Growth	Pile Material	Size	Holes/Cavities	Pile Bracing	% Remain Pile Condition	Remarks
28	Fender	Mod-Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
28	A	Mod-Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
28	Batter	Mod-Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
28	B	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
29	Fender	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
29	Fender1	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
29	Fender2	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
29	Fender3	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
29	Fender4	Heavy	Timber	Class B			<30	Destroyed, hanging from cap
29	A	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
29	Batter	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss
29	B	Heavy	Timber	Class B			80-100	Incipient Limnoria attack, moderate creosote loss

Dolphin #	Marine Growth	Pile Material	Size	Holes/Cavities	Pile Bracing	% Remain Pile Condition	Remarks
N-1	Heavy	Timber	Class B		No lower cables	<30	destroyed
N-2	Heavy	Timber	Class B		two high cables	80-100	
N-2.5	Heavy	Timber	Class B			<30	completely rotted off, below water level, growth on top of stubs
N-3	Heavy	Timber	Class B		upper & lower cables, lower rusted bad	80-100	leaning shoreward, possibly hit hard
N-4	Heavy	Timber	Class B		upper & lower cables, lower rusted	80-100	one pile rotted off
N-5	Heavy	Timber	Class B		No lower cables	80-100	interior appears to be rotten
S-1	Heavy	Timber	Class B		two high cables	80-100	
S-2	Heavy	Timber	Class B		two high cables	80-100	outboard destroyed
S-3	Heavy	Timber	Class B		No lower cables	80-100	outboard destroyed
S-4	Heavy	Timber	Class B		No lower cables	80-100	
S-5	Heavy	Timber	Class B		No lower cables	80-100	leans north 10° off vertical

APPENDIX B

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